RADIOFREQUENCY CATHETER ABLATION OF ACCESSORY PATHWAYS: THE INITIAL EXPERIENCE IN SINGAPORE

W S Teo, A Tan, T T Lim, A Ng

ABSTRACT

Radiofrequency catheter ablation is a recently introduced non-surgical technique for curing patients with arrhythmias as a result of conduction over an accessory pathway in patients with the Wolff-Parkinson-White (WPW) syndrome. We present our initial experience with this technique. There were 90 patients (61 males, 29 females) with a mean age of 37±14.4 years (range: 13 – 73 years). All except one were symptomatic with a mean duration of symptoms of 10±9.4 years (range: 0.1 – 40 years). The indications for catheter ablation were failure of drug therapy in 71, patient's preference in 10, increased risk of sudden death in 6 and almost incessant tachycardia in 3. The radiofrequency ablation was performed using a deflectable 7 French 4 mm tip electrode catheter positioned at the mitral or tricuspid annulus. The site of the accessory pathway was localised by electrophysiological study and radiofrequency energy applied via the tip of the catheter. There were 100 accessory pathways as 10 (10%) patients had multiple accessory pathways. There were 69 (69%) left free wall, 11 (11%) posteroseptal, 13 (13%) right free wall, 6 (6%) right anteroseptal accessory pathways and one (1%) midseptal accessory pathways. Ninety-six percent (96%) of the accessory pathways were successfully ablated on the first ablation. Two of the 4 initially unsuccessful ablations were successfully reablated, giving an overall success rate of 98%. There were no major complications. In conclusion, radiofrequency catheter ablation of accessory pathways is highly successful and safe and provides a definitive cure for patients with the WPW syndrome. It eliminates the risk of sudden death and the need for life long drug therapy and should be offered in the initial management of patients with symptomatic WPW.

Keywords: *Wolff-Parkinson-White syndrome, curative, supraventricular tachycardia.*

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INTRODUCTION

Patients with accessory pathways commonly present with complaints of palpitations due to recurrent supraventricular tachycardia. The surface electrocardiogram may manifest preexcitation showing the classical delta waves of the Wolff-Parkinson-White (WPW) syndrome or may be normal because of concealed accessory pathways. In those with preexcitation on the electrocardiogram, they may be at risk for sudden cardiac death when atrial fibrillation with rapid conduction down the accessory pathway occurs[1-3]. Drug therapy was previously the only option available but it could only control the tachycardia and was not curative, and life-long drug therapy was required. In some patients too, drug therapy was either ineffective or resulted in significant side effects. Curative therapy became available with the advent of antiarrhythmic surgery but had significant morbidity and the rare mortality[4,5]. Thus although surgical ablation of accessory pathways has been available in the Singapore General Hospital, Singapore since 1989, it did not become popular as a therapeutic option.

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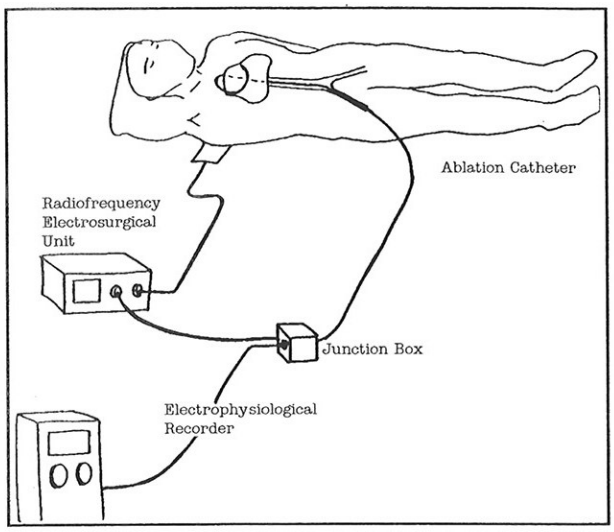
Catheter ablation is a non surgical technique for curative therapy of patients with certain cardiac arrhythmias. It was initially used for ablation of the atrioventricular (AV) node[6,7] and subsequently used successfully for ablation of accessory pathways[8-16], modification of the AV node[17,18] and for therapy of patients with ventricular tachycardia[19]. The initial energy used was mainly DC energy[8-11] but the results were not encouraging, with reports of significant morbidity and mortality. The introduction of radiofrequency energy[12-16] with its more localised and discrete lesion size and without the problems of barotrauma associated with DC shock, made it safer and more acceptable. The major drawback was the need for very precise localisation of the abnormal site for ablation. In 1991 we started on a project to perform radiofrequency catheter ablation and the first patient had radiofrequency catheter ablation of his accessory pathway on 10 October 1991. We review here our initial results of the use of radiofrequency catheter ablation as curative therapy for patients with arrhythmias due to accessory pathways.

METHODS

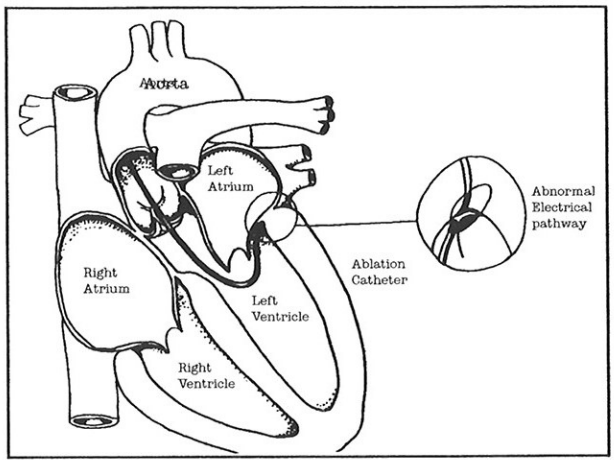
There is no single commercially available unit for radiofrequency ablation. We use the Radionics RFG-3C electrosurgical unit for generating the radiofrequency energy. The catheters used were either the Mansfield-Webster Polaris or the United States Catheter and Instruments (USCI) steerable catheters with a 4 mm large tip deflectable electrode catheter. This was connected to a junction box to allow for easy switching from recording mode to the electrophysiological amplifier and recorder or to ablating mode to the Radionics electrosurgical unit. A back plate was attached to the patient's left scapular region (Fig 1). Radiofrequency ablation was performed using a deflectable 7 French 4 mm tip electrode catheter positioned at the mitral or tricuspid annulus either by the retrograde transaortic approach or via the transeptal approach to the mitral annulus for left sided pathways (Fig 2) or via the femoral vein or right subclavian vein to the tricuspid annulus for right-sided pathways. Only one patient had ablation for a left-sided accessory pathway via the transeptal approach.

Fig 1 – Simplified diagram showing the equipment involved in catheter ablation.



The catheter tip was positioned either below or above the valve leaflet. The site of the accessory pathway was localised by standard electrophysiological studies and accessory pathway potentials when present were also looked for. Briefly, this involved the use of 4 endocardial catheters which were inserted via the left subclavian vein to the coronary sinus and via the right femoral vein to the right ventricular apex, His bundle and high right atrium. Once the accessory pathway was localised, radiofrequency energy of 30-35 watts was delivered via the tip of the ablation catheter for 30-60 seconds. Post ablation, the patients were observed in the ward for another 48 hours before they were discharged.

Fig 2 – Diagram showing the retrograde transaortic approach for ablation of left lateral accessory pathways.



A total of 155 patients underwent radiofrequency catheter ablation from October 1991 to February 1993. The study group consisted of 90 patients that underwent radiofrequency ablation of the accessory pathway. The rest of the patients had radiofrequency modification of the AV node and one patient (who had a permanent pacemaker for sick sinus syndrome) had AV node ablation for atrial tachycardia.

RESULTS

There were 90 patients with a mean age of 37±14.4 years (range: 13 to 73 years). There were 61 males and 29 females. All were Chinese except for 2 Indians and one Burmese. All except one had significant symptoms. The duration of symptoms ranged from 0.1 to 40 years (mean 10 ± 9.4 years). All the symptomatic patients had history of palpitations with 8 patients having a

Fig 3 – 12 lead electrocardiogram showing preexcitation over an accessory pathway preablation.

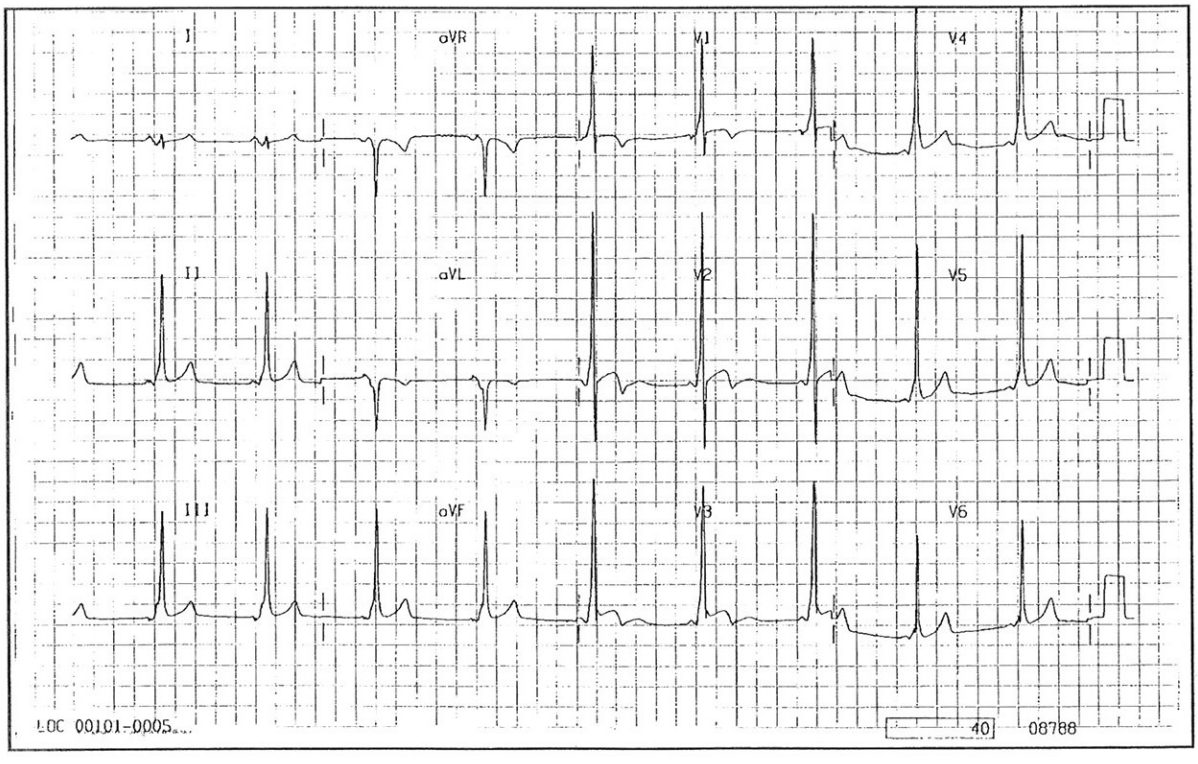


Fig 4 – Loss of preexcitation during radiofrequency application (aVF, V1 and V6 represent surface ECG leads, HRA – high right atrium, CSp – proximal coronary sinus, CSd – distal coronary sinus, * marks the onset of radiofrequency application, Time scale – each small box represents 100 ms).

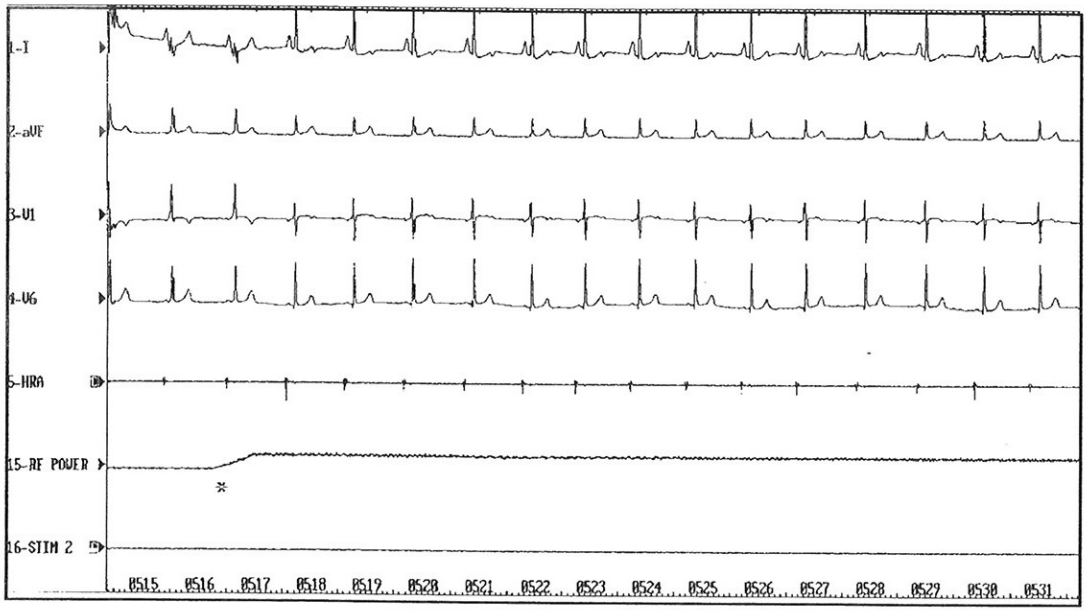
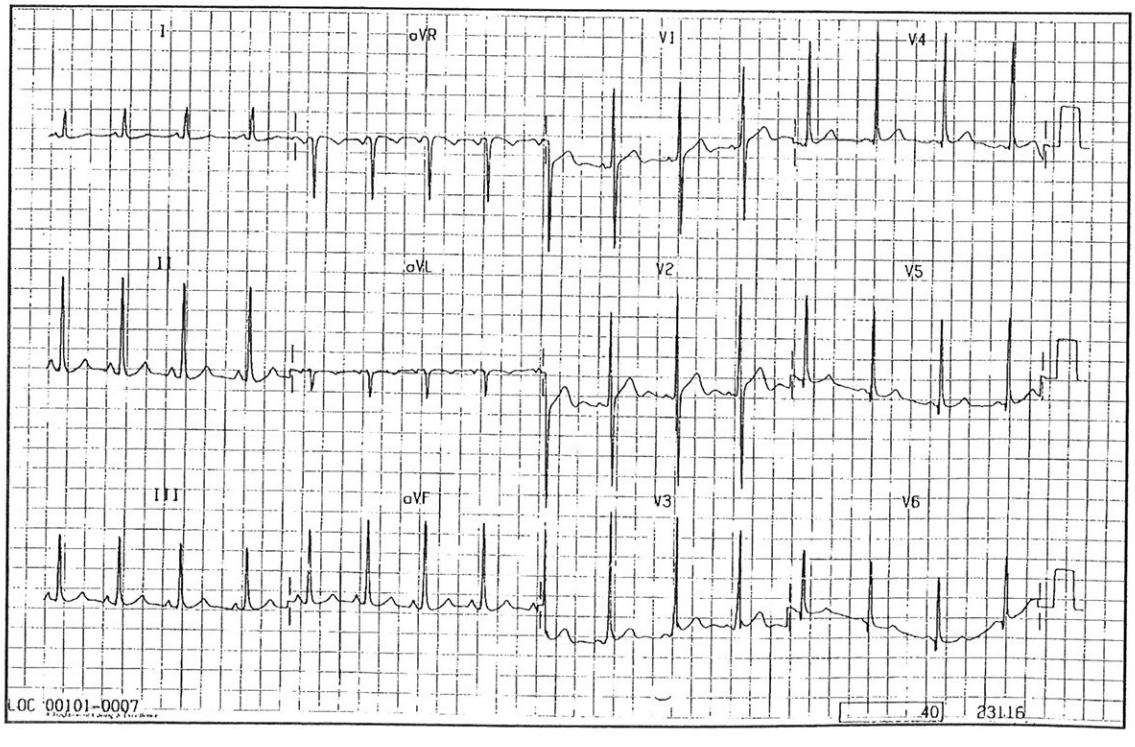


Fig 5 – 12 lead electrocardiogram showing loss of preexcitation immediately after radiofrequency ablation.



history of syncope as well. Five additional patients had history of near syncope. Five patients had associated mitral valve prolapse, 5 had history of hypertension, 2 had tachycardia induced cardiomyopathy, one had rheumatic aortic incompetence, one had Ebstein's anomaly, one had mitral stenosis and one had documented coronary artery disease with previous myocardial infarction.

The indications for ablation included failure of drug therapy in 71 patients, patient's preference in 10, increased risk of sudden cardiac death in 6 and incessant tachycardia in 3. The 90 patients had a total of 100 accessory pathways as 10 (11%) patients had 2 accessory pathways. Of the 100 accessory pathways, there were 69 (69%) left free wall, 11 (11%) posteroseptal, 13 (13%) right free wall, 6 (6%) right anteroseptal accessory pathways and one (1%) midseptal accessory pathway. Radiofrequency catheter ablation was successful in eliminating accessory pathway conduction in 96 (96%) of the 100 accessory pathways. All the left free wall, right anteroseptal and midseptal accessory pathways were successfully ablated. Of the 4 patients that failed ablation, 3 had accessory pathways located in the right free wall and one in the posteroseptal region. Two of the patients, who had right free wall accessory pathways, had successful reablation, giving an overall success rate of 98%. The majority of the patients (95%) had loss of conduction over the accessory pathway within 10 seconds (Fig 3-5). A minimum of one to a maximum of 20 radiofrequency applications were needed for successful radiofrequency ablation. An extra 3 minutes to 210 minutes were needed to successfully ablate the accessory pathways after a brief electrophysiological study was done to localise the accessory pathway. Fluoroscopy time was a mean of 35 ± 29 mins (range: 6 – 122 mins). There was no evidence of a significant rise in cardiac enzymes with a peak creatinine kinase of 200 ± 106 U/L. There was no major complication. Two patients developed a small pneumothorax while another had a small haematoma over the left subclavian region after a subclavian puncture for cannulation of the coronary sinus. Another patient had incomplete right bundle branch after ablation of a concealed right anteroseptal accessory pathway. There has been no clinical recurrence in any of the patients that had successful ablation of the accessory pathways. Forty patients has had a repeat electrophysiological study at 12-24 weeks after their ablation and there was recurrence of accessory pathway conduction and inducible but nonsustained atrioventricular reentrant tachycardia in 3 (7.5%) of the patients. These were successfully reablated.

DISCUSSION

Our study shows that radiofrequency catheter ablation of accessory pathways can be successfully performed in patients with the Wolff-Parkinson-White syndrome. Our initial result with a success rate of 96% and an overall success rate of 98% if reablation are included, is comparable to that reported in the literature[12-16]. Jackman[14] reported a 99% success rate in 177 accessory pathways present in 166 patients. Similarly Calkins[15] reported a success rate of 93% in 56 patients while Lesh[20] reported a success rate of 89% in 100 patients who underwent radiofrequency ablation of the accessory pathways.

The left free wall accessory pathways were successfully ablated in all cases but failures were seen in right free wall and posteroseptal accessory pathways. One reason for the ease of left free wall pathway ablations is that the ablation catheter when introduced into the left ventricle by the retrograde transaortic approach tends to point in the left lateral region of the mitral annulus and only a small amount of manipulation is required to position the catheter below the mitral valve at the AV annulus. It is thus advisable to start a radiofrequency catheter ablation programme with attempts at left free wall ablations initially. Leather et al[21] similarly found that left lateral accessory pathways were more easily ablated.

The high success rate coupled with minimal morbidity and mortality suggest that catheter ablation in experienced centres can now become the method of choice for curing patients who are otherwise at risk from sudden death or suffer from recurrent disabling symptomatic tachycardia. We ourselves have not had any mortality from the use of radiofrequency ablation, but we would caution that there is a potential for mortality when done by inexperienced operators and should only be performed in experienced centres and personnel who have undergone formal training in catheter ablation. Previously, surgery[4,5] was the only modality but the relatively high morbidity makes it a less favourable option. Radiofrequency catheter ablation can provide curative therapy with minimal morbidity and thus can now be offered as an alternative to life long drug therapy in younger patients and was in fact the choice in 10 of our patients as they felt that they did not want to be burdened by long term drug therapy with its financial cost and possible side effects. The issue of cost has been studied by DeBuitleir et al[22] which showed a reduction in medical care cost associated with radiofrequency catheter ablation compared with surgical ablation of accessory pathway or long term drug therapy.

In conclusion, radiofrequency catheter ablation is highly successful and safe and provides a definitive cure for patients with accessory pathways. It also eliminates the risk of sudden death or the need for life long drug therapy and should be offered in the initial management of patients who are symptomatic.

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